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TELEGRAPHIC COMPETITION.

THE sounds of telegraphic warfare that are wafted across the Atlantic appear to us, on this side, like history repeating itself. We have seen the same phases of determined opposition, we have suffered from the same causes, we have surmounted the same troubles, but we have landed on safe shores, and can survey with untroubled minds the serried ranks of the opposing forces. Competition is a thing of the past in inland telegraphy; it is left to our Submarine Commercial Companies.

It is one of the misfortunes of success to excite envy and rivalry. No one can watch profit without desiring to share in it. The early losses and disasters of the first telegraphists in this country were no sooner recovered, and the enterprising speculators showed their heads above water and began to profit from their speculations, than rivals sprouted up to rob them of their rewards by underbidding them to the public. *Delirant reges plectuntur achivi;* but in this case the people had the best of it, for competition meant lower tariffs, and lower tariffs meant the public benefit. The Electric begat the British, the British begat the Magnetic, and these begat the United Kingdom, *et hoc genus omne*, until a wise and paternal Government stepped in, swallowed the whole, and begat the uniform shilling. Our American cousins are familiar with telegraphic enterprises and telegraphic competition, but now the combatants are practically reduced to two powerful companies—the Western Union and the Atlantic and Pacific. The latter are the assailants, and have commenced the battle by reducing the tariff from 40 cents to 25 cents for ten words, between New York and Washington and other places. The enormous area of the United States precludes a uniform tariff: hence they have a 25 cents, a 40 cents, and a 60 cents tariff, with 2, 3, and 4 cents for each additional word. The Western Union have followed suit, and to the same extent. Both companies are relying upon duplex, quadruplex, and automatic system for despatch and the means to accommodate the extra business anticipated. Both parties are said to be bitterly hostile, and bent on performing that operation familiarly known to us in the story of the Kilkenny cats. The longest purse will perhaps win. The Western Union Company have just secured a million from the London market, which will materially aid their operations. Congress is also very active in discussing telegraphic projects in connection with the Government, and it will probably end—as it has in Great Britain—in the establishment of a national telegraph. Of course the telegraphic fraternity and press in America are opposed to this movement; so were we in England, but we were beaten, and we are not sorry for it. We have cheap Telegraphy; we have wonderful facilities everywhere, especially to the press; we have great despatch in the transit of messages; and we have a decided improvement, in every shape and form, in the transaction of telegraphic business. But, say the opponents to Government absorption in America, it does not pay—no national telegraph pays. True it does not pay as a commercial speculation, earning handsome dividends; but who wants it to pay as such? Again, they say estimates have been exceeded; but they forget that the business has also exceeded the most sanguine estimates. If all the claims that remain outstanding against the British Government—preposterous as they are—be paid in full, what does it amount to? The nation will have paid about five shillings per head for their telegraphs,—and who is there who has not saved this in the economy effected, the convenience acquired, and the despatch assured by the new system? There is not a reader of a penny paper who is not benefitted by the change, and the inhabitants of sparsely populated districts would never have been brought within the range of civilisation but for its means. Moreover, there is the feeling in the public mind that the telegraphs are its own, and it has a control over their working,—nor does it fail to let this control be felt, either through the press or in the House of Commons, when anything goes wrong. The national system of telegraphs in England—like the Post-Office, with which it is allied—is the most closely supervised department in the world, for the eyes of its master—the public—are everywhere. It is therefore bound to work well, and it unquestionably does so. American telegraphy will not be satisfactory until it is in the same category.

THE VOLTAIC BATTERY.

A COURSE OF SIX LECTURES,

By DR. JOHN HALL GLADSTONE, F.R.S.,

Fullerian Professor of Chemistry, Royal Institution.

DELIVERED AT THE ROYAL INSTITUTION OF GREAT BRITAIN.—CHRISTMAS, 1874-5.

(Continued from page 53.)

I SHOULD like to show you now the decomposition of other substances. We may take the wires a long way from the decomposing cells. I do not myself know where the batteries are which are connected with these wires, but they are a good way from this table at any rate. We can bring the power up into

this room, and here we can produce decompositions just similar to those which I showed you taking place at the last lecture. We will have a representation upon the screen of some decompositions of metallic salts. We might go, if we pleased, through the whole range that we took at the last lecture, and show the reduction of silver, and copper, and tin, and bismuth, and gold, and any other salts; but I think we will confine ourselves to three metals. We will take lead first of all, and we will see how it will behave. We have a small cell with flat sides, and we have the two poles of the battery—the ends of the two wires—in the solution. You see them sticking up. Directly the galvanic power is put on we shall see that the lead salt is decomposed, and we shall get crystals similar to those which we had before. There are the crystals of lead growing very large, as you saw them in the lead tree. You will understand that they only appear on one of these poles. The lead, which is the positive element, goes towards the negative wire, and there the crystals stretch across. Here we have one of these leaves put sideways towards us, making its way very rapidly. Here are others turning in various directions, and, at the same time, seeking the positive pole. If they came actually to touch the two poles, then the currents would go through the metals themselves, and we should have no more decomposition; but we ought to be able to reverse the current, and let it go the other way through the liquid. We ought then to have the metal appearing on the other pole. Ought we not? Let us see whether it does so. Now the current is reversed, and we ought to see the growth of crystals from the opposite pole, and at the same time the bubbles appearing where the crystals had been before. [After a few seconds the action became manifest.] Look at this strange sort of spiderlegs appearing. Here is a bunch of very respectable crystals at the bottom, but these long thin things twist about above. This one is going in a very straight methodical business-like way right across, and will soon reach to the other side. Now we have the oxygen appearing on the other pole, but we have no time to watch it any longer.

Now let us have tin. You recollect the tin—how it was built up, having the appearance, not so much of fern leaves, but of leaves that were at right angles one to the other.

In the meantime, while this is being prepared, I may show you what I have not showed you already—that we get hydrogen from water by means of this zinc foil covered with spongy copper. If I take a light we shall find that the hydrogen will burn. [A light was applied, and the hydrogen which had been collected burnt with a slight flash.]

Now I hope we shall be able to see the tin forming. It is a curious thing for you to observe that these crystals have all the same form as they had the other day. You may remember that when I showed them to you before there was no galvanic battery at all. We were only dealing with a zinc plate and a solution of tin. There was, in fact, a galvanic or voltaic cell, but it was a self-formed cell. [Upon a current being passed through the solution of tin, a rapid deposition of tin crystals from one of the poles took place.]

We will have another experiment of the same kind. We will try silver and see what crystals it gives us. Here are the two wires for the display of silver. You recollect the former appearance of silver crystals. In this case there is a growth on both poles. We have here the silver crystals forming on one side, but on the other side we have a growth of crystals too. They are differently shaped, and if you saw them properly in a microscope you would see that they were black crystals of oxide of silver.

Well, these are beautiful things to look at, and beautiful things to think about, and this strange growing—nature's first attempt at architecture, if we may call it so—reminds me very often when I look at it, of a story in a good book which I hope all of you are fond of reading, and which tells about the building of a great temple, and how all the timber and stones were prepared at a distance from that temple, and not at the place itself. We read how the cedar came from Lebanon, and other timber from elsewhere, and how the wood and stones were all got and squared according to the plan of the Great Architect; and how, when these things were all prepared at a distance, the materials were all brought together at Jerusalem by seventy-thousand strangers, who were captives, and who were made bearers of burdens. And we read that there was neither axe nor hammer, nor tool of iron heard during the progress of the building. Now this seems to me to be something like that. Here we have a beautiful building taking place before our eyes; but who are the invisible workmen, and the seventy-thousand carriers of burdens? We can see something of the plan. The design—the intention of the Great Architect in this case—is plain enough; but by what agency does he work? Clearly, in this case, we must trace the effect to a great extent by the imagination. We cannot see what it is that bears this invisible tin, and lead, and silver, or how it is carried along through this liquid. I tried a gross way of showing you this by means of balls two days ago, and we can possibly imagine how the metal may be carried all through the liquid and deposited in the right place, to build up these beautiful crystals in all their elegance.

I should like to show you some more decompositions of liquids, though I have hardly time to do so. I have here, however, a solution of sulphate of soda, and it is coloured with a little cabbage water. On passing a current through it, we see that a decomposition takes place, the sulphuric acid going to one side, and the soda to the other, and this is made evident by the change of colour.

But I want to speak of some of the great discoveries that have been made here in this house upon this matter. A good deal of the work of electro-chemistry has been done in the laboratories of this institution, and the names of Davy and Faraday are associated with it for all time. As for Davy, when first this power was made known, and when the voltaic pile was brought over to this country, he set to work, and soon began to decompose one thing after another, performing such experiments as I have been showing you—experiments with salts and experiments with metals, endeavouring to split up one thing after another, and often succeeding in doing so, and making some of the most brilliant discoveries. And Faraday afterwards followed in his steps, and showed that this decomposition was very regular—that it was connected with the chemical decomposition that

was going on in the cell—and that, in fact, as I have put in the notes of this lecture "the quantities of chemical elements separated by means of the same amount of voltaic force stand in a constant relation to one another, namely, that of the chemical equivalents." He found that there were regular numbers governing this electrolytic decomposition. For instance, if he got one part of hydrogen by decomposition, he could get with the same force 108 parts by weight of silver, or 100 parts of mercury, or 32 parts of copper. That is, the same force which would set free 100 parts of mercury would set free only 32 parts of copper. And so on with all the other elements. Of magnesium there would be only 12 parts set free. This is one of the most wonderful laws which was discovered by Faraday in this institution, and which connects together galvanism and chemistry, in the most indissoluble bonds.

Now I want to show you in the remaining five minutes some of Davy's most remarkable experiments in decomposing substances. He thought that if we could separate metals so easily from their salts, as you have seen in the case of lead, and silver, and tin, we could decompose all salts, and he asked himself whether there were not a great number of things which were considered to be elements, but which were really compounds, and he thought that he might be able to tear a metal out of them if he could get a sufficiently larger amount of force. So he took all the force he could obtain from all the batteries he could get together, and worked away at the different substances that he supposed might be compounds. Among them were potash and soda. Nobody had decomposed these alkaline earths before, and nobody knew that they were like the ordinary oxides, such as oxide of zinc, oxide of iron (iron rust), or oxide of copper; but he thought that they might be such oxides, and that if he was to try them he could succeed in getting a metal out of them. I repeated some of his experiments at this table in preparing this lecture, but though they succeeded the results were not visible at a distance. I will show them to any of you afterwards, if you wish to see them. By passing the current from the battery wires through damp potash, he was able to get out of it a metal which is called potassium—the metal which I have here. It is a very soft metal, which looks something like lead, but it is much softer than lead, so that I can squeeze it between my fingers like putty. It is also a very light metal, and will float on water, and it does something else than float when it is thrown upon water. It takes fire, as you see, and burns with a rose-coloured flame. Davy produced another metal—sodium—from soda, which is very much like potassium in its qualities. He also obtained potassium combined with mercury. He tried then the volatile alkali which we call ammonia, and he got the elements of it to combine with mercury too. I will show you this, as it can be made visible to the audience. I have a small quantity of mercury at the bottom of this vessel, and I can pass a current up through the mercury, and then through a solution of chloride of ammonium. We will look at the result after a minute or two. This discovery of potassium was, perhaps, Davy's most important discovery. He recorded the various steps in his note-book which I have here, and this of course is a very precious document. He describes the most conclusive experiment thus: "When potash was introduced into a tube having a platinum wire attached to it, and fused into the tube so as to be a conductor, *i.e.* so as to contain just water enough, though solid—and inverted over mercury—when the platinum was made negative, no gas was formed, and the mercury became oxydated, and a small quantity of the alkaligen was produced round the platinum wire, as was evident from its quick inflammation by the action of water. When the mercury was made the negative, gas was developed in great quantities from the positive wire, and none from the negative mercury; and this gas proved to be pure oxygen." Davy makes in his note book a drawing of the arrangement of the apparatus, and then he writes at the end of the account "Capital experiment, proving the decomposition of potash." A capital experiment it was!

Now you see how largely this mercury has increased in volume. It has swollen up through its combining with some of the elements of the chloride of ammonium. It is not only growing, but I can turn it out into some other vessel, and show you what sort of stuff we have got. You see it is not mercury such as it was before. It is a buttery material, which I can handle much more easily than I could handle mercury. If I had taken potash instead of ammonia salt, I might have made a combination of mercury and potassium. You see I am employing the old alchemical term in saying "mercury," instead of "quicksilver." Here I have mercury and sodium combined together, and we will pour upon it some of this chloride of ammonium, and see whether we do not get this curious compound by another kind of action. [A voluminous soft "buttery" amalgam was the result of the mixture.]

ON THE

CONSTRUCTION AND MAINTENANCE OF LIGHTNING CONDUCTORS.

By R. FRANCISQUE MICHEL.

(Concluded from p. 46.)

EARTH contact (*prise de terre*), properly so called, is the perfect and intimate contact that should exist between the end of the conductor and the ground or common reservoir. An early method of making earth contact consisted in multiplying the iron bars attached to the end of the conductor, and plunging them for some diameters into well-water. Theoretically, if the joints are well made, and the parts (kept clear) are immersed deep into the well, this arrangement is sufficient; but, if long neglected, this part of the system should be re-made. Besides, and I insist upon this point, one must never be contented with mere water contact; a soil well diluted in all seasons is far preferable.

To attain this end, it suffices if, as M. Viollet-le-Duc has done with his mansion at Pierrefonds, we penetrate into the moist ground to a certain depth one or several metallic branching stems connected with the conductor. On this principle a strong grating furnished with points has been constructed to be sunk into the bottom of wells. M. Callaud, of Nantes, in a recent pamphlet, describes an arrangement which he uses, in which the conductor is terminated by a kind of galvanised iron

grapnel placed in a sort of wicker basket, filled with fragments of coarsely pounded coke. In principle this idea is good. With the desire, however, to increase the surface in contact with the humid earth as much as possible, I propose to employ the galvanised grating or harrow first mentioned, and of which Fig. 7 is a sketch. My plan

Fig. 7.

is to place it between two layers of horn embers (*charbon de cornue*), which are denser than water; a first layer being placed at the bottom of the well, and the harrow forcibly sunk into it. The jointing of the conductor with this harrow should be made with all possible care, and embedded in a little heap of melted zinc.

When a sheet of water is at hand, the lightning conductor thus arranged will be in the best possible condition; but when far away from wells, ponds, or streams of water, one is limited to the moistest part of the neighbouring ground, and there to bring the conductor, and give it at that place the greatest possible development by means of suitably arranged ramifications, terminating at the feet of trees. In default of being able to do better, this "earth" may be considered as sufficient. In a town, making of "earth" for the lightning-conductors of public monuments will not present any difficulty. Main water-pipes and gas-pipes offer large metallic surfaces. It is therefore simply needed to fix the conductor to one or the other, or better still, to the whole pipe system, in order to establish good communication with the common reservoir. In some cases sewers may be utilised.

For a certain number of years, galvanised iron wire cables have been used for conductors instead of iron bars. Considering their flexibility, their erection is more easy, especially for clock towers and buildings, whose exterior access is difficult, or where architectural details are very numerous and varied; very considerable unsoldered lengths may also be obtained. Considering their pliancy, all dilatation will be resolved into curvatures of small radii, without decreasing the hold of the hooks; lastly they are galvanised, a quality not found in the iron bars of a certain length. These are real advantages. Nevertheless the following precautions must be taken:—It is necessary that the cable be under the same conditions as a bar of iron, that is to say that over its whole length the electricity divides itself between all the wires of which it is composed. Now, the wires are not united rigorously enough for their lateral contact to be sufficient. Consequently, at the contact of the stem with the conductor, the latter should be let into and soldered into a special piece of iron, and pinned and fixed, as already described in Fig. 3. On making a splice, care must be taken to cover it with solder. If one of the wires composing the cable breaks, it should, after being replaced in position, be soldered at the point of fracture. Lastly, the juncture of the cable with the harrow should be similar to its juncture with the stem, and afterwards surrounded with melted zinc.

M. Callaud, in his pamphlet, explains a method of tying to the stem which I absolutely reject. It is to worm the base of the stem, to surround it with a loop made from the cable, and to fasten this loop by a bolt. M. Callaud's cable is of copper; the contact of copper with iron will occasion a rapid oxidation of the latter metal; it will be in vain to tighten the bolt, for this joint will present a resistance more and more considerable. As a general rule the pieces composing lightning conductors should not be simply placed in juxtaposition or bolted together; all the joints should be covered with a layer of solder at least one millimetre thick.

Manifold are the questions whether, when there is a real advantage in using a metallic cable instead of iron bars, the cable should be of iron or red copper. By virtue of the differences of conductivity, a conductor of galvanised iron, 2 c.m. diameter, may be replaced by one of red copper wires half the diameter. But then the cost will be much more; besides copper, much less resisting than iron, in a mechanical point of view, undergoes with rapidity under the influence of electric currents and atmospheric variations, both a kind of disaggregation and temper, rendering it fragile and brittle—*i.e.*, in a very short time its primitive solidity is much altered. Lastly, it will always be inconvenient to employ for lightning conductors two metals (copper and iron) in close contact, since upon the latter metal oxidation will be produced. When a difficulty is met in using iron bars, I think it will be preferable to make a cable of iron galvanised wire; and in every case a diameter of 20 m.m. will be sufficient.

I will now examine two opinions broached by M. Perrot. (1.) Should the number of points at the summit of every lightning conductor stem be multiplied? (2.) Ought the large metallic masses included in the construction of a building to be united to the conductor?

(1.) Experience teaches that, on the approach of an electrified cloud, the more points there are the greater (within a certain limit) will be the neutralising effect. When a stem, according to old usage, has but one point, it acts only in one direction. But if there is a large number of stems branching in all directions, the preventive effect

Fig. 8.

will be considerably increased. This arrangement may be easily carried out by having the ordinary

conical-trunk copper arrow on the top of the stem melted down and fashioned so that, at about half its height, it will present a tolerably distinct circular swelling. Into this swelling let arrows be fixed, inclined at each side of the horizontal plane to an angle of 45°, as in fig. 8.

By using six arrows or points for each inclination, there will be twelve alternately in each direction. Radiating in all directions they will hasten the neutralisation of the electrified cloud; and, in the event of a discharge, the discharge, by dividing amongst them, will prevent their fusion.

(2.) M. Perrot considering it necessary to isolate, with great care, lightning conductors from metallic masses which form part of the building, recommends the use of a glass insulating ring. Now the elementary laws of physics prove clearly that, when a lightning conductor is in action, we may freely approach it and even touch it, since all the electric fluid runs through it alone. There can, therefore, be no inconvenience if we bind the conductor to these metallic masses: there is found, on the contrary, a great advantage therefrom; for these masses being in connection with the earth themselves, give a certain amount of preventive effects; besides, if we assume as an extreme case that they are struck, being in communication with the earth, the building will be saved.

From M. Melsen's experiments, it appears that Ohm's laws* are equally true when electricity of a high potential is concerned. He considers therefrom a great advantage is obtained in multiplying the number of conductors, at the same time to give to each a smaller section, until only a simple wire of stout diameter may be used. He likewise recommends as much as possible that the points should be multiplied around the building, so as to make it a veritable aigrette. That gentleman also enunciates the following rule:—

All metallic pieces of tolerable size should be put in communication with the lightning conductors, so as to form closed metallic circuits, that is to say by two points, or at least to two conductors.

By metals he means those which are not in communication with the common reservoir, as, for example, when they are found near the ground. For want of the ability to carry out this rule, the junction of the metallic masses should be effected as near as possible to the soil.

HOLTZMAN'S SYSTEM OF UNDERGROUND TELEGRAPH LINES.

By J. F. NIERMEYER,
Sub-Director at the Central Telegraph Station at Amsterdam, Holland.

THE want of underground telegraph lines has been felt since telegraphing commenced. Every telegraph book and periodical contains lamentations about inconveniences attending the overhead system, and the high cost of continual repairs and maintenance. A thoroughly good and cheap underground system will accordingly replace advantageously the defective overhead system.

Mr. A. Holtzman, at Amsterdam, Holland, has done a great deal in this way.

Finding almost all the qualities of gutta-percha in a bituminous compound named *brai liquide*, not to be confounded with other bituminous compounds, he has spent a great deal of money in making experiments with it on a large scale, first to replace the gutta-percha by his compound, and afterwards to use it as a protection for a very small and consequently cheap size of gutta-percha wires.

The method of constructing lines in the open air by bending copper or iron wires in cast-iron gutters, and filling them up afterwards with melted compound, proved itself too much dependent on weather and temperature.

The experiments of fabricating telegraph cables with the compound succeeded perfectly well, but the expedition of the cables being too difficult, that mode of exploitation was abandoned, and the studies were continued in another direction.

A good underground line should be almost everlasting, and therefore care had to be taken to have the outer protector made of a strong, tough, durable material. The interior protector must be invariable, elastic, insulating, air- and water-proof, not subject to chemical influences, and not acting chemically on the insulating material with which the conducting wires are covered. The gutta-percha coverings must be of a size sufficient for a good insulation among the conducting wires, and by those coverings a sufficient distance to prevent galvanic induction should be maintained among the wires. If necessary, a single or double tape could make the distance longer. For outward protector were chosen gutters of strong, thoroughly creosoted firwood, it being proved by the experience of half a century that wood is the most strong and invariable of all substances.

The compound should increase the insulation of the conducting wires, protect them against desiccation by surrounding them everywhere, and never, under any circumstances, must it be given to hardening and consequently breaking or splitting. The *brai liquide* possesses all those qualities, as has been attested by many experiments. It melts at a temperature of 70° to 80° Celsius, and remains plastic even at 15° under zero.

Very interesting experiments have been made by chemical men to examine if ever the compound can in any way injure the gutta-percha by influencing chemically on it. It is found that by coal-tar distillation the nuisible substances are extracted first, and if perchance there should be left a little of them, they will be so much mixed up with and dispersed in the compound as not being able to give any nuisance.

For having a fair trial, 60,000 metres of gutta percha wires No. 7, making a line of twelve wires at 5000 metres length have been put, without being taped, in gutters filled with melted compound. Finished in August, 1873, this line still shows a perfect insulation, while the compound and the gutta-percha are both in a very good state. A second experiment has been taken with several gutta-percha wires laid in a solution of 50 per cent *brai liquide*, and 50 per cent oil of creosote. After having remained two years in this compound, the gutta-percha is entirely unchanged.

If, nevertheless, there could remain any doubt on this subject, very reliable and easy means are left to protect the wires against all possible corruption by tar oils. I will gladly give information to anybody who wishes to know those means.

* The laws of the distribution of electric currents in conductors, and the laws of derived currents.

The materials being known, a short description will do for knowing all about constructing the lines.

After having dug a ditch of about 30 English inches deep, the gutters are placed as much as possible horizontally on the bottom of it and steadied; when necessary, at intervals, by a piece of wood. The joints are made by bringing the ends of the gutters towards each other in a block of creosoted wood carved out for that purpose, and by strongly nailing them on the said connecting block. Afterwards the gutters are filled with liquid, Holtzman's compound, melted in iron tubs.

The compound being cooled down to 30° or 40° Celsius, the wires or cables (covered or not with the anti-oil substance) are put in the compound and covered with it. The compound then is still sufficiently liquid without being able to injure the gutta-percha. The best and easiest way of knowing the temperature of the compound is putting the hand in it.

Care must be taken to have the gutters filled at once before laying the wires in them. The wires then are put in and surrounded on all sides with the compound. This done, the coverings are strongly nailed on the gutters, the ditch is re-filled, and the work is finished.

As the invariably tough and plastic compound gets a strong hold of the strong and indestructible gutters, injuries to such a line cannot possibly occur. Against sinking away and breaking in a swampy soil, precautions must be taken; besides these cases, only a volcanic eruption can injure it.

The line of 60,000 metres near Amsterdam is put in a very bad swampy soil; nevertheless splits do not occur.

No. 5 of the *Journal Telegraphique* of Berne, dated 25th March, 1870, contains a description of experiments taken in Cologne, with underground cables. Speaking of the bitume which had been covering the cables about fourteen years, it was mentioned as being stone hard (*dur comme la pierre*). I believe this is just what should be avoided for telegraphic purposes. If the said cables were buried very deep, they may perhaps not have been shaken by riding above them, but the bitume growing so very hard. I think it very much subject to breaking or splitting, which will be always a very dangerous evil. As aforesaid, the Holtzman's compound can not grow hard nor split, because it is shut up in the gutters, and this is doubtless a very valuable quality of the system.

A second advantage is the opportunity of increasing the number of conducting wires at little more cost. The price of the Holtzman lines is much lower, as that of the cable system. With a line of fourteen wires it differs more than half of the price; when increasing this number, the difference becomes too great for comparison. Every one can calculate the amount of what an underground line costs. The prices of creosoted wood and gutta-percha wires are known everywhere; the compound costs fifty shillings a 1000 kilos. A cubic metre of compound weighs 1240 kilos.

Other costs as for digging a ditch and re-filling it, putting the gutters, melting the compound, filling the gutters, laying the wires in them, and putting the coverings, can be also easily calculated. Twelve labourers can construct daily about 200 metres of line. One of them must be perfectly acquainted with making gutta-percha joints, and, of course, all must be constantly and scrupulously controlled.

Having thought it my duty to make universally known a method of constructing telegraph lines, which I am convinced is not only cheap but also reliable, and wishing to promote the introduction of it everywhere, I will gladly and without any cost inform anybody who wishes to know more about it.

THE TALE OF A RAT.

It having become necessary on a recent occasion, in one of our large provincial towns, to withdraw a cable of gutta-percha wires from some iron pipes, in a busy thoroughfare, the inspector in charge commenced operations shortly before midnight, to avoid the crowding which otherwise generally attends such feats in the daytime. The flush boxes being opened the men commenced hauling, the wires travelling with remarkable ease, till suddenly the workmen were interrupted by a shout from the inspector. They had forgotten to attach the iron wire to the other extremity of the cable, which is indispensable to the pulling in of a new or the return of the old cable when necessary. However, it was no use crying over spilt milk; the cable could not be thrust back, so the work was concluded, the boxes closed, and our friend retired to a restless couch with the conviction that he had done a stupid thing. After sundry turnings and twistings a "happy thought" struck him, and, his mind at rest, he fell into deep repose.

The following day at the same hour, having invoked the aid of a rat catcher, and, armed with a large rat, a ferret, and a ball of string wound on a Morse paper drum, he returned to the scene of his former exploit. The boxes were opened, and the rat having previously had one end of the string firmly attached to his body, was put into the pipe. Charmed with unexpected liberty, monsieur scampered away at a racing pace, dragging the twine with him until he reached the centre of the length of pipe, when he stopped to investigate matters. The ferret was then put in, but the sight was enough. Off went the rat again until he sprang clean out of the next box. One length was thus safe, and the same operation was commenced with the other; but the rat objecting to be made a cat's paw of, stopped short a few yards in the pipe, and boldly awaited the approach of the ferret. A terrific combat then commenced, cries and shrieks reaching the ears of the alarmed spectators outside, who dreaded, not only an utter failure of the second operation, but a stoppage of the pipes by one or more dead bodies. After sundry violent jerks had been given to the string however, the combatants, alarmed at such unexpected interruptions, separated; the ferret returned to his master, and our friend the rat, making for the other extremity of the pipes, carried the string right through, and so relieved the inspector from his anxiety.

The traffic receipts of the Great Northern Telegraph Company for the month of February were, this year, 256,146 francs; last year, 293,206 francs. Total traffic receipts 1st January to the 28th February, this year, 522,167 francs; last year, 617,672 francs.

Notes.

LEEDS is setting a capital example in establishing an Exhibition of Scientific Apparatus, illustrating —and necessary for studying or teaching—the various branches of Natural Science. The object is essentially educational. It is hoped that our instrument-makers—especially those of magnetic and electric apparatus—will forward the scheme by making large exhibitions. No charge is made for space, and amateurs are specially provided for.

An ingenious engineer of Glasgow, Mr. Alley, has applied the expansion of thermometer due to heat to complete a circuit, and to indicate—by ringing a bell and moving an indicator—the heating of the bearings of machinery.

In *All the Year Round* for February there is an excellent description of Silvertown, and its various manufactures and operations.

The India-Rubber, &c., Company have issued their Report, and it proves a contrast to the reports of the other construction companies; for though they have netted a good profit, they are unable—owing to their misfortunes in the West Indies—to declare a dividend. The Company are adopting the novel practice of making and laying a sound cable, and developing a business before selling it to the public. They did so in the case of the Spanish Direct Cable, and are just sending out an expedition to Chili and Peru for this same purpose. The public are more likely to be better served by this practice than by subscribing to a new Telegraph Company whose cables are neither made nor laid, and whose returns are neither known nor developed.

The Central American Telegraph Company announce that they have received information to the effect that the line from Para to Cayenne and Demerara, as also the lines from Trinidad to St. Croix and Porto Rico, have been successfully completed, thus giving direct telegraphic communication between Brazil, the West Indies, and North America. These lines will, in accordance with agreements, become the property of the West India and Panama Company.

The traffic receipts of the Western and Brazilian Telegraph Company, Limited, for the four weeks ending the 26th of February, were £8842.

The number of messages passing over the Cuba Submarine Telegraph Company's line during the month of February was 2079, estimated to produce £2200, as against 683 messages—producing £478—in the corresponding month last year.

The Eastern Telegraph Company's traffic receipts for the month of February, 1875, amounted to £32,765, against £31,084 in the corresponding period of 1874.

The Eastern Extension (Australasia and China) Telegraph Company, Limited, notify that their traffic receipts for the month of February, 1875, were £16,415, against £17,706 for the corresponding period of 1874.

The fourth International Telegraph Congress will meet on the 1st of June, at St. Petersburg, in conformity with the decision arrived at, at the Roman Congress. The Russian Government some time since forwarded invitations to the twenty-four States which have adhered to the Convention, and to twenty Submarine Telegraph Companies. With the exception of the United States, all have accepted. The British Post Office will be represented by Mr. H. Fischer. Brazil, the Argentine Republic, and Japan, are the new States which will be represented at the Congress, which is expected to last forty days. The private companies have only a consulting voice, the official representatives of States alone having the right to vote.

Mr. Charles Burton, Director-General of Telegraphs for the Argentine Republic, and Honorary Secretary of the Society of Telegraph Engineers, has just left England on his return to Buenos Ayres. Since his sojourn here he has been making himself familiar with our system, and on his return will probably be able to introduce some improvements into the Argentine working. He contemplates introducing the duplex system of working.

An exceedingly ingenious and pretty application of Electricity has been received from Paris. It is an electric "tinder-box," or lamp-lighter. It is the invention of MM. Voisin and Dronier, and its principle is described in vol. ii., p. 225. A little spirit-lamp, charged with benzole, is placed beneath a fine "spongy" platinum wire. A knob or plunger is depressed, which dips a zinc plate into a solution of bichromate of potash in which two carbon plates are fixed. This completes a circuit of which the platinum wire forms part, and which consequently becomes *red* hot by the current, *white* hot by the hydrocarbon fumes, and thereby hot enough to inflame the benzole. One of these instruments is said to be able to furnish 15,000 lights before the zinc requires renewal. It is a novel application of Electricity to domestic purposes, and a useful adjunct to a house. It is about the size of a small money-box or tobacco-jar, and stands well and ornamentally on the chimney-piece. Its price is 15s., and it is sold by Alabaster and Co., 57, Ludgate Hill, London.

The *Ambassador*, with the cable for the River Plate, left on Saturday, the 27th inst.

ELECTRIC EARTH BATTERIES.

In the year 1838, Steinheil made, on the railroad from Nürnberg to Fürther, an experiment in using the rails as conductors for telegraph despatches; but he found that the current passed through the earth from one rail to the other, and then he conceived the idea of using the earth for the return current, thus saving half the wire. He found that it not only worked perfectly, but better than a wire for the return current, as the earth and one wire gave only half the resistance given by two wires, which were used before this great discovery, which was of the utmost practical importance to the progress of the telegraphic art. The manner in which this method of using the earth for the return current is applied is to bury, at each of the two terminal stations of the line, a copper plate in the moist earth, and connect it by means of a wire to the telegraph apparatus or battery. Gauss, in repeating this experiment, conceived the idea of leaving the battery out altogether, and burying at one station a large copper plate, and at the other a large zinc plate; and he found that a powerful electric current then passed through the wire. This arrangement is evidently nothing but a single voltaic pair, constructed on a large scale, as the layer of moist earth of a few miles in thickness between the metallic plates replaced the layer of acidulated cloth, paper, or liquid in the cell.

Bain applied this arrangement to his telegraph, so as to obtain a current of long duration and constant quality. He buried a series of zinc and copper plates, opposite to one another in the moist earth, and connected them by insulated wire; and so obtained a current of sufficient strength to work his telegraph. According to the same principle, a variety of voltaic batteries or generators of electricity have been constructed, by means of which Bain, as well as Robert Weare, kept his electric clocks in constant and very regular motion. Such an earth battery remains in similar activity until, in the course of time, one of the metals has become entirely oxidised, which oxidation, according to experience, takes place only very slowly when large plates are buried deep in the moist ground.

The most extensive application of such batteries was made by Steinheil on the railroad from Munich to Nanhofen; the line was 22 miles long, and the earth battery was completely successful in performing not only the service required on the road itself, but also in serving for the sending of despatches for the public. The metal plate in Munich was of copper, of 120 square feet, while in Nanhofen a zinc plate of the same size was buried; both plates were sunk so deep as to reach the level of the subterranean well water of the locality, and connected with isolated wires to the air line. The current thus established was used to effect the deviation of a magnetised needle in a galvanometer, which Steinheil used as the basis of his system of signals, a system requiring only a very feeble electromotive force, a force entirely insufficient to move the electromagnets of the Morse system, or the hand of a dial telegraph.

The construction of such earth batteries, easy and simple as it appears to be, has never become a settled practice, for reason of the laborious digging required, it being much easier to plunge plates in cups and renew them after a while, than to dig up the oxidised zinc plates in order to replace them by new ones. However, when a river or brook is at hand, the practice can be recommended; as in that case a zinc plate has only to be sunk at a convenient and safe spot. Then at any time, if the current becomes weak, the plate may be easily replaced by a fresh one; while in place of the copper, a quantity of coke may be buried in the moist earth. The great objection to this form of battery is, however, the unavoidable total lack of intensity: as the latter quality depends on the number of cups, and the earth or water acts as but one single cup, and thus the burial of several plates is equivalent only to the immersion of them in a single cup. If the plates are connected for quantity, that is, all the zincs together and all the coppers or cokes together, the series will act like a single pair of which the surface is equal to the sum of the individual plates, and thus as one pair of large surface; if, however, the plates are connected for intensity, that is, every alternate zinc to the next copper, only the two plates at the extremes of the series will be of use, because the several intermediate pairs discharge mutually all the electricity generated into the moist earth, through their metallic connections, which shows the fallacy of the advantage claimed for some earth batteries lately constructed and even patented.

Of all the batteries thus far constructed, the most constant appears to be that of Leclanché; it is to a certain extent an imitation of an earth battery. It consists of a large piece of coke surrounded by coarsely pulverised manganese and coke, all contained in a porous cell and surrounded by amalgamated zinc plunged in a solution of sal-ammoniac. This battery has, during the last ten years, been more and more used in France; and according to the testimonies of the telegraph operators there, it far surpasses all others, for reliability and constancy.—*Scientific American.*

Proceedings of Societies.

SOCIETY OF TELEGRAPH ENGINEERS.

Wednesday Evening, February 24, 1875.

Mr. Latimer Clark, President, in the Chair.

After the usual business had been transacted, the President announced the completion of the formalities respecting the gift of the Ronalds Library, and that in the course of a few days the books would be transferred to the Society's rooms. The Catalogue in Sir Francis Ronalds's handwriting was in the possession of the Society, and a portion of it was exhibited to the meeting.

The paper read was "*On Induction between Suspended Wires as affecting Automatic Transmission*," by R. S. Culley, Vice-President. It had been noticed in the automatic working of the London and Dublin circuits over the new Holyhead line that certain interferences took place, apparently of a character similar to contact between the wires. During the interruption—in August, 1874—at the Holyhead-Howth cable, experiments were conducted by Mr. A. Marson, of Mr. Culley's Staff, to investigate the causes of these interferences. A careful series of experiments proved that the causes were entirely due to induction. The wires in question—four in number—proceed under-ground from the Central Station to Paddington; thence along the Great Western Railway to Chester, *via* Oxford, Birmingham, and Shrewsbury; from Chester they are carried along the main road (with the exception of a short section on the Anglesea Railway) to the cable hut. The total lengths were—Under-ground, 10 miles 1648 yards; road, 75 miles 833 yards; railway, 216 miles 1457 yards; giving a maximum length of 216 miles 1457 yards. These wires were of No. 4 B.W.G. as far as Chester, thence of No. 8. Two wires

were principally experimented on: the two lowest wires on the pole the farthest side of the railway; the upper being in an arm 33 inches long, the lower in one 24 inches, the distance between the arms being 12 inches. In the experiments a Bain's chemical decomposing apparatus was used, fitted with two styles, the one insulated from the other; the metal band over which the chemically-prepared paper passed was also insulated. The one style was connected with one of the wires, the other direct to earth. The paper was prepared with potassium iodide. To the second wire under experiment was attached a key with a battery of 100 cells. It was found that as this wire was disconnected at Holyhead, Chester, Birmingham, &c., and signals sent, marks became visible on the chemically-prepared paper: these marks—varying in intensity and length on the length of line disconnected—decreased, until they ceased altogether, when only the Paddington under-ground was alone in circuit. The mark made on the paper was of a "comet" or "tadpole" form, and lasted but a short time, no mark being visible whilst the key remained depressed, but immediately the key was released a more elongated dash appeared at the style connected with the earth. When the wires were disconnected and put to earth—at Holyhead, Chester, Birmingham, Oxford, Reading, and Paddington successively—it was found that the marks were always tapering and gradually reduced in magnitude when the line was disconnected, but when it was put to earth the marks became square-ended dashes. A double-current key, sending reversals, was found to give increased effects; and the various phenomena observed agreed perfectly with the well-known laws of Induction. Numerous wires were experimented upon, and the results came out in accord with those laws. The induction was greatest with two wires suspended only about 12 inches apart; it was much less between the two wires on the same arm, 24 inches long; and very much less between two wires in an arm 33 inches long. It would appear that it will in future be necessary to allow greater space between suspended wires when pursuing the same route for many miles, as in high speed automatic transmission interference—whether by induction or contact—would be undesirable. It was remarkable that in the long under-ground lines formerly in work between London, Manchester, and Liverpool, no induction had ever been noticed between wire and wire, whilst between wire and earth the induction was so great as to materially interfere with working. Similarly, in some carefully-conducted experiments extending over some hours, on two of the wires in the North Sea cables, no interference was observable to be due to the ordinary working of the other lines.

Mr. PREECE then explained the phenomena and action of induction, &c.

A ballot took place, when the following candidates were elected:—

Foreign Members.—Lieut. Frederick Dreyer, Royal Danish Navy, Great Northern Telegraph Company, Shanghai; Lieut. Edouard Luenson, Royal Danish Navy, Great Northern Telegraph Company, Copenhagen; Don Rafael Gimenez, Santiago; Don Luis Zignago, Federacion, Argentine Republic; Don Manuel Ramira, Antonio Tomas, Argentine Republic.

Members.—John Fuller, Stratford; Bennett Pell, Eastern Extension Telegraph Company, Singapore.

Associates.—Shotto McK. Douglas, Eastern Extension Telegraph Company, Singapore; George Fuller, Stratford; Conrad W. Cooke, Marlee Terrace, Clapham; R. Price Williams, Great George Street; George E. Dering, Lockleys, Welwyn; Henry Starke, Government Telegraph Department, Brisbane, Queensland; Jacques Ducloy, Submarine Telegraph Company; Major Granville Puget, 34th Regiment, Carlisle.

INAUGURAL ADDRESS, BY MR. LATIMER CLARK, PRESIDENT. JANUARY 13, 1875.

(Concluded from page 58.)

I MUST now take leave of the Electric Telegraph Company, with which I was so long and pleasantly associated, merely recording that its successive Engineers were Mr. W. H. Hatcher, Mr. Edwin Clark, Mr. Latimer Clark, Mr. Cromwell F. Varley, and Mr. Richard S. Culley. The Company has now become merged in the Telegraphic Department of Her Majesty's Post-office, and under the able administration of that department its growth and progress have outstripped the most sanguine calculations.

On the 30th of last June, the Post-office system comprehended 106,730 miles of wire, and 1451 miles of submarine wire, exclusive of Railway Companies' wires, and of the Continental and other cables of the various Telegraph Companies. The number of telegraph offices open to the public on the 31st of December was 5572, and the number of telegraphic instruments in commercial use was 9220. The growth of the traffic may be seen from the number of messages, which was as follows:—

December,	1871	11,760,518
,,	1872	14,858,020
,,	1873	17,294,334
,,	1874	19,116,634

It is gratifying to observe that the consolidation of the telegraphs into a Government system has in no way tended to retard the progress of telegraphy, or to discourage invention. Although the able officers of the Government must have been at times hardly taxed to meet the growing requirements of the service and the difficulties incident to the transfer of a vast network of rival telegraphs and their consolidation in one centralised system, they have been throughout among the foremost to seize upon every scientific invention or idea, and to test its practical adaptability to the wants of their system.

I could have wished to have touched further upon the history of the other Telegraph Companies, to have spoken of the introduction of the Pneumatic system, of the various automatic and type-printing telegraphs, of the duplex system, and of the exquisitely scientific instruments of our retiring President Sir William Thomson; also of the history and development of submarine telegraphs, of underground wires, and of the progress of telegraphy in other countries; but time forbids, and I must reserve space for a few words about ourselves.

I believe the present Society owes its existence chiefly to the wisdom and energy of Major Frank Bolton and Major Webber, R.E., who foresaw the probable success of the institution, and the benefits which it would confer on all engaged in telegraphic practice or electrical research. As we are all aware, it has been warmly supported by the profession both at home and in foreign countries, and, what is still more gratifying, our list of members comprises the names of some of the most eminent scientific men of the age, and of many who are entirely unconnected with telegraphy. I should like to see this division of our forces greatly extended.

I remark with pleasure that several of our great Submarine Telegraph Companies have given us cordial support, and their officers, who are so exceptionally well circumstanced for making observations of the highest value, have contributed admirable papers to our *Transactions*. We have also been fortunate in receiving the valuable co-operation of the department of Royal Engineers, and many of our best papers have emanated from that highly scientific body.

Our *Journal* continues to maintain its character It has now reached its seventh number, and is becoming a work of considerable historic and scientific value.

Our example is beginning to be followed in other countries, and already an American Electrical Society has been constituted in Chicago.

The present number of our Members is 650.

I will not occupy your time by giving a list of the telegraphic works which have been executed during the past year, since they are well known to most of us, and are abundantly recorded elsewhere. But I will refer to a few of the more interesting novelties which have recently occupied our attention. Among these, I give the first place to the reintroduction of the Bain system of telegraphing by punched paper and chemical decomposition, to which I have alluded in the earlier part of my discourse—if the promises which this system appears to hold out are realised, it will have a powerful influence on telegraphy.

The next discovery I would notice is that of Mr. Edison, of Newark, U.S., who has made the interesting observation that when an electric current traverses a strip of paper moistened with certain solutions it acquires an extremely slippery surface, and taking advantage of this, he has constructed an instrument which may hereafter prove of much value in telegraphy.

Mr. Elisha Gray, of Chicago, has turned his attention to the transmission of signals by sound—he has exhibited instruments by which musical sounds and even chords are perfectly transmitted over telegraphic wires, and by his latest researches he finds that seven or eight or more different sounds can be all transmitted simultaneously over one wire, and, by springs vibrating in unison with the several notes, can be separated at the end. He is now engaged in applying this principle to telegraphy with prospects of success.

M. Clamond of Paris has so improved the well-known thermo-electric pile as to render it probable that it may to a great extent supersede the use of the ordinary voltaic battery.

The Duplex system, now so well known, has been also re-introduced from America, and I allude to it here, not only to point out the activity of thought and invention that is now going on in America and on the Continent, but to show how much remains to be done by original research and experiment, and how desirable it is that we should re-investigate, with the aid of the improved knowledge and appliances we now possess, the inventions and ideas of our predecessors. A boundless field now lies open to research, and I trust before long this Society may be in a position to offer the advantages of a laboratory, of electrical instruments, and of artificial lines and cables, to any of its members who may desire to prosecute fresh researches.

I have no doubt the most interesting and gratifying part of my address will be the announcement I am able to make to you this evening, that the acquisition by this Society of the valuable library of our late lamented member Sir Francis Ronalds is now complete. Our sorrow for his loss is tempered by the remembrance that he lived to witness, to an extent perhaps never before vouchsafed to man, the wondrous success and development of that telegraphic system which he had done so much to perfect and to advance in his early life, and by the gratification which we know it afforded him to receive at the hands of his Sovereign a well deserved recognition of his services to his country.

By his will he bequeathed his library, which it had been the amusement of his life to perfect, to his brother-in-law, Mr. Samuel Carter, of Battle, and this gentleman, in fulfilment of Sir Francis Ronalds's desire, that the library should be made available to all students of electricity, has transferred the whole in trust to this Society, with a reversion to the Royal Society, of which he was so distinguished a fellow, in the event of this Society becoming extinct. The deeds are now before me approved and only requiring execution. Among other provisions it is stipulated that the collection shall be termed the "Ronalds' Library," and that we shall at once publish the complete catalogue, which it has been the labour of his life to perfect; also that under due restrictions the library shall, as far as possible, be open to all who desire to consult it, and that we should apply for a charter of incorporation.

I do not yet know the precise extent of the library, but I observe that in a letter of the 29th March, 1870, to the Right Hon. W. E. Gladstone, acknowledging his intimation that Her Majesty had expressed her intention of conferring the honour of knighthood on him, he says "this procedure may tend, in some small measure, to promote my endeavour to complete a much roquired Electrical Library, of which about 10,000 books and other writings are collected, the fruit of many years' search, and which I intend to bequeath or give to public use."*

This valuable collection of works will shortly be transferred to our rooms at Broad Sanctuary, and supplemented by the complete copy of the *Transactions of the Royal Society*, recently presented to us by Mr. Louis Crossley, of Halifax, and, by the gifts of others already promised or presented to us, and by our own purchases, it will form one of the most complete special libraries in the world.

I can assure our Members they will find the older writers, as well as the more modern ones, well worth their attentive perusal, and full of suggestive thought and experiment. Occasionally they will meet with surprises as regards priority of discovery. Even in my own cursory reading I have been interested to observe that Galvani was not the first to discover the galvanic convulsions of the frog. That that elegant instrument the Peltier electrometer was an English invention of the last century. That Oersted was not the first to observe the influence of the galvanic current on the magnetised needle. That Wheatstone was not the earliest originator of the electric balance, and that Thomson was not the first to use the instrument we familiarly know as the "Mouse Mill," or to perform the beautiful experiment of dropping zinc filings through a copper funnel in order to discover the difference of potential induced by the two metals.

There is only one other subject on which I will detain you this evening, and that subject is no other than the constitution of the Society itself.

This Society, as you are well aware, has been modelled on the lines of the parent Society—the Institution of Civil Engineers; our rules, our constitution, and our proceedings, have all been closely copied from theirs. Our object is the general advancement of electrical and telegraphic science, and most fully have the hopes and intentions of the founders of the Society been thus far realised.

As a natural result of our close imitation of the illustrious body in whose rooms we are now assembled, our proceedings and constitution have assumed, in a marked degree, a technical character, and there are those among us, and I confess I am one among the number, who consider that, while giving the highest consideration to practical telegraphy and applied electricity, we shall fail in covering all the ground which rightfully belongs to us, if we do not equally cultivate both of the objects of the Society, and endeavour to attract the lovers of pure science, and to make ourselves as much an Electrical Society as a Society of Telegraph Engineers. Any one who will revert to the inaugural address of our distinguished first President, and to the observations of those who spoke on that occasion, will perceive that that feeling is a very prevalent one, and one worthy of our attention. It is true that our technical character is, in one sense, a

* It is believed that the Catalogue contains a list of about 10,000 works and pamphlets, and that the library consists of about 5000.

great source of strength, and it has, doubtless, been the means of attracting many Members who join our ranks, partly on account of the professional value and interest of our papers, and partly from a feeling of professional *esprit de corps*. It would be most unwise to take any steps which could by possibility weaken this feeling, but at the same time it behoves us to observe that we have not yet enrolled in our ranks, to any great extent, that large body of private scientific workers who love and pursue the science of Electricity without any thought of regarding it as a profession. The earliest society of this character—"the London Electrical Society," which was established in 1841 under the able presidency of our distinguished Member Mr. C. V. Walker, F.R.S., and whose proceedings form a valuable contribution to the history of Electricity, relied entirely on the support of this class of members: and the rapidly increasing appreciation and love of physical science, has caused, and will cause, their numbers to increase immensely; and it is among such as these that we may confidently look for the brightest discoveries of electric research. Now many of these will ask themselves what right have I to consider myself eligible among a Society of Telegraph Engineers, or what affinity have I with them?

The Royal Society will ever attract to itself the most important papers on subjects of high philosophical research, but other societies will certainly arise to fill the electric void if we leave it vacant. Already the want has been felt, and a *Physical Society* has been constituted, which is destined, doubtless, to attract many lovers of pure electrical science, who would willingly join our ranks if the character of our Society were more adapted to their requirements.

It has been suggested that some friendly alliance or amalgamation might be formed with this young but important Society, and if anything of the kind is to be attempted, or any effort is to be made to give our own Society a more purely scientific character, it is evident that it should be done soon or not at all. Possessed of these views, I have gladly welcomed a proposition that I should become a Member of the Council of the "Physical Society," and should I be elected to that office, would use my best efforts for the harmony and welfare of both Societies. It is probable that this important question will be again brought under your notice, but in the meantime I have thought it of sufficient interest to address you upon it from the chair.

I have now, Gentlemen, to thank for the patience with which you have listened to my remarks, and to ask you all to lend your earnest assistance and co-operation throughout the year in endeavouring to increase the influence and prosperity of the Society of Telegraph Engineers.

Correspondence.

CLOSED CIRCUITS.

To the Editor of the Telegraphic Journal.

SIR,—In the number of your Journal for January 15th, I find the question asked, "Why is the closed circuit system not in use in England?" The first idea that would strike one as to the disadvantage of the closed circuit system would be that the battery is continually in action when the line is not being worked, and that, consequently, a large unnecessary consumption of battery materials is occasioned. Here, however, I am met with a difficulty. On referring to Mr. Culley's Handbook, fifth edition, p. 16, I find that the osmotic action which takes place between the liquids in the Daniell's battery (such being the kind I believe, almost universally used in England) is stated to be assisted by the current. This being the case, a further disadvantage in the use of the closed circuit system appears. But on referring to another authority, viz., "The Electric Telegraph," by Robert Sabine, p. 223, I find the followlng:—"Another cause of the inconstancy in the action of the Daniell's element arises from the solution of copper entering the chamber appointed for the solution of zinc. This process of destruction of the element takes place faster during the time the circuit is open than when it is closed." Still further, on referring to the number of the *Electrician* for Feb. 7th, 1862, I find the following, which refers to a visit made to the instrument room of the Electric and International Telegraph Company at Telegraph Street:—Our attention was directed to what appears to be a very efficient and economical method of working a circuit of moderate length, in which several stations are included, by means of one battery at either of the extreme stations; whereby the expense and trouble of a battery at every station is avoided." After describing at some length the arrangement of keys, &c., the writer goes on to say: "It might be supposed that the continuous action of the battery would be attended with a great expenditure of material." This, however, does not appear to be the case; the increased consumption of zinc in the production of voltaic effect being compensated in great degree by the diminution of *exosmosis* of the upper solution in the porous vessel of the battery cell, while the battery is in action—the escape of this solution and its action upon the zinc element being a source of waste, which in practice is greater than the legitimate wear and tear of the battery.

As the telegraphists of America probably incline to this latter view of the case, and those of England to the statement of Mr. Culley, the difference in the methods of working may possibly be accounted for thereby. The question then arises which takes the correct view of the case.

INQUIRER.

Electrical Science in English and Foreign Journals.

Annalen der Physik und Chemie, von J. C. Poggendorff. 1875. No. 1.

The Electric Conductivity of the Chlorides of the Alkalies and Alkaline Earths, as also of Nitric Acid in Aqueous Solutions.—F. Kohlrausch and O. Grotian.

Electric Sparks.—K. Antolik.

On a Universal Meteorograph for Solitary Observatories.—E. H. v. Baumhauer.

Continuation of Researches on Steel Magnets.—A. L. Holz.

On the Measurement of Angles, by Means of the Eye-Piece Micrometer, of Astronomic Telescopes. M. Matern.

Relation of Specific Heat under Constant Pressure and Volume.—J. J. Müller.

Observations on Gaseous Spectra.—E. Goldstein.

Spectra of Gases.—W. Wüllner.

Speed of Sound in Water in Pipes (preliminary communication).—V. Dvorak.

Bulletino Telegrafico. Anno x. December, 1874.

The non-official portion of this number contains a continuation of the paper on the Telegraphic Administration in England (commenced in the October number), taken from *Fraser's Magazine*. There is also a full account of the loss of the *Plata*, and a notice of the machine for recording votes in legislative assemblies (see TEL. JOURN., vol. ii., p. 72).

THE traffic receipts of the Direct Spanish Telegraph Company for February were £1104, against £1654 in January. The Lizard and Santander Cable was interrupted during the whole of February.

POST-OFFICE TELEGRAPHS.—Statement showing the total number of messages forwarded from Postal Telegraph Stations in the United Kingdom during the week ended the 27th February, 1875, and during the corresponding week of 1874:—1875, 350,846; 1874, 329,245; increase in the week of 1875 on that of 1874, 21,601.—Week ended 6th March:—1875, 352,293; 1874, 336,979; increase in the week of 1875 on that of 1874, 15,314.

THE *Journal des Debats* notices a very ingenious application of electricity applied to voting in the National Assembly. Electricity is already used in the theatre which French legislators have adopted as their debating-house. The numerous gas-jets which light up the House in winter are ignited by electric wires, which operate instantaneously, to the great delight of country visitors, who are not aware of the progress which their representatives have made in the art of saving time. French Deputies, however, should not be content with this innovation—they should adopt a system of voting somewhat less awkward and unsatisfactory than the plan now in use. The House generally "divides" several times, and, except when a show of hands, or rising and sitting suffices, servants wander about the House with huge tin boxes, into which the members drop a white or blue card, accordingly as they vote "Yes" or "No." The cards have then to be sorted and counted before the result can be proclaimed. This is a long and tedious process, and an unsatisfactory one in this sense, that a member can vote for all his absent friends, and sometimes forgets to do so, or votes for a friend against the friend's opinion. A clerk employed in the Government Telegraph Office (M. Jacquin) has conceived a system for recording votes by electricity. The *Debats* decribes it in the following terms:—"Before every Deputy two ivory buttons are placed, like the buttons of electric bells. If the Deputy wishes to vote 'Yes,' he presses the button on his right; if he wishes to vote 'No,' he presses the button on his left. The voter establishes by this means an electric communication, which is transmitted to an apparatus close to the President and his secretaries. Every time the electric current acts thus it opens the door to a ball, and the ball falls through a tube into the ballot box. The balls are made of glass or ivory, and are strictly identical in weight. The two ballot-boxes are then weighed, and the number of balls is indicated by the weight. Finally, by turning a handle all the balls which have not been used are let out, and they give the number of members who have abstained or were absent when the vote was taken. Nothing can be more simple. M. Jacquin has offered to set up his apparatus in the Versailles Assembly for the sum of 60,000 frs. Time is money." The *Debats* mentions also another plan invented by M. Martin, a well-known electrician. M. Martin's plan does away with the scales, which might not always be true. Accordingly, as the vote is black, a piece of coloured pasteboard appears instantaneously above a line bearing the name of the Deputy. Before each Deputy is a small box, supplied with two buttons. When he presses on one or the other, he discloses the piece of white or black card on the board. This system has much in common with that used in hotels to indicate the number of the room from which the electric signal has come. The sum total of the votes for either side is marked on a totalising board. The advantage of this system over that presented by M. Jacquin is, that it enables the President to see whether a Deputy has not voted because he abstained or because he was absent. A member can, by placing his hand on both buttons, vote at once "Yes" and No," and be thus numbered among the abstainers. It cannot be said, however, that any benefit is conferred on the Chamber by enabling its members to record the votes of abstainers. French Deputies are too much given to manifesting their indifference in this way, and it can hardly be of much importance to constituents to know whether their representatives did not know which way to vote, or whether they were absent.—*Times*.

DR. STEPHAN, the head of the Post Office of the German Empire, has been directed to take charge provisionally of the Telegraph Department, with a view of amalgamating the two departments, as has been done in Great Britain.

THE Western Union Company have fitted up in their new offices in New York 7000 cells of the Callaud or gravity battery—the average weight of each cell being about 20 lbs. They employ in their operating room 215 males and 75 females, separating the latter from the former by a partition eight feet high! There are 87 tables in this room, each constructed for four sets of apparatus, and intersected by framed clear glass partitions 12 inches high to separate the sound of the instruments from each other. There is a daily transmission of about 27,000 messages, and there are:—

Morse instruments (Sounders) ..	149
Phelps' printing instruments ..	6
Duplex	15
Quadruplex	7
Milliken's automatic repeaters ..	4
Button repeaters	6

To Correspondents.

*** **Duly authenticated contributions, theoretical and practical, on every subject identified with the interests of which "THE TELEGRAPHIC JOURNAL" is the organ, will always command attention. Anonymous correspondence will be wholly disregarded. Literary communications and books for review should be addressed to the EDITOR; business communications to the PUBLISHER.**

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A CORRESPONDENT writes from Falmouth—"I should be glad if you would kindly inform me, in the next number of the TELEGRAPHIC JOURNAL, whether the neutral line of a bar magnet remains in the same place, after a piece or pieces of soft iron have been placed in contact with it, as it was before the iron was put into contact with it. I find, in some books, that the pieces of iron become part and parcel of the magnet; if so, would not the neutral line be altered? In others the writers say the pieces of iron become polarised, each having a North and South pole."

[The pieces of iron certainly do not become part and parcel of the magnet; they each possess a North and South Pole; but whether the position of the neutral line is altered we cannot answer, and we should be glad if some correspondent would examine the point experimentally.—ED. T. J.]

D. S.—The book is in the press, but will not be out for two or three months. The retail price of Weinhold's book is 31s. 6d.

MR. MACDONA does not seem to be aware that the Alphabetical Instrument is very largely adopted in England, and especially by private individuals. His instrument would be far more complicated and xpensive than those n use. There is nothing novel in his idea.